

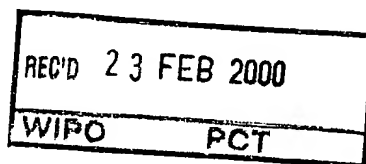


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Request for Grant of a Patent



The Patent Office  
Cardiff Road  
Newport  
Gwent NP9 1RH

1. Your reference **DW/P83280 GB**

2. Patent Application number  
(the Patent Office will fill in this part) **9902780.7**

3. Full name, address and postcode of the or  
of each Applicant (underline all surnames)  
Latchways plc  
Redman Road  
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Wiltshire  
SN11 9PL

Patents ADP Number (if you know it)

If the applicant is a corporate body, give  
the country/state of its incorporation

England

*C73 15344001*

4. Title of the Invention **SAFETY LINE ANCHOR**

5. Name of your Agent (if you have one) **URQUHART-DYKES & LORD**

"Address for Service" in the United Kingdom to  
which all correspondence should be sent  
(including the postcode)

91 Wimpole Street  
London  
W1M 8AH  
Great Britain

Patents ADP Number (if you know it)

1644002 ✓

6. If you are declaring priority from one or more  
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| Country | Priority application No.<br>(if you know it) | Date of Filing<br>(Day/month/year) |
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7. If this Application is divided or otherwise derived  
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| Number of earlier application | Date of Filing<br>(Day/month/year) |
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8. Is a Statement of Inventorship and of Right to Grant  
of a Patent required in support of this request ?  
(Answer 'Yes' if:

Yes

- a) any Applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an Applicant, or
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| Description                     | 8 |
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| Drawing(s)                      | 5 |

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Priority documents

Translations of priority documents

Statement of Inventorship and Right to Grant a Patent (*Patents Form 7/77*)

Request for Preliminary Examination (*Patents Form 9/77*)

Request for Substantive Examination (*Patents Form 10/77*)

Any other documents (*please specify*)

1

1

11.

I/We request the grant of a Patent on the basis of this Application

Urquhart - Dykes & Lord

Signature Date 8 February 1999

URQUHART-DYKES & LORD

12. Name and daytime telephone number of person to contact in the United Kingdom

D. Watkins - 0171 629 1771

# Warning

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## SAFETY LINE ANCHOR

The present invention relates to height safety equipment and, in particular, to an anchoring arrangement suitable for anchoring the lower end of a temporary installation of a flexible elongate safety line disposed in a substantially vertical orientation on a tall structure.

5 Tall structures such as electricity pylons and radio or satellite communication masts are periodically inspected to determine whether any maintenance work is required. These structures are purposely built to be low maintenance and, because many of them stand in remote locations, they may require inspection only once every ten years, perhaps longer.

10 Also, in the interests of public safety, such structures are constructed to discourage easy ascent by non-authorised personnel. Hence, the lower leg portions of metal towers of this type are usually plain metal to a height of at least three metres from ground level, with no foot- or hand-holds. In fact, if such structures were built with access-ways or the like, the access-ways  
15 themselves would require periodic inspection for compliance with safety regulations. The interval between routine safety inspections is shorter than the required interval between routine maintenance inspections, so it would significantly increase the frequency of inspection for any kind of permanent access-way to form part of the tall structure.

20 Traditionally, personnel who have carried out maintenance inspections on metal towers, pylons, or the like have used rope-access techniques for ascent and making themselves fast at the top. In an effort to minimise some of the hazards associated with such work, the present applicants have devised a fall arrest system that can be installed temporarily on a tall structure for the  
25 duration of a routine maintenance inspection, then removed and installed on another tall structure and so on. The advantage of a temporary installation is that it does not require safety inspection *in situ*. Rather, the system can be removed to a convenient inspection site and inspected whenever necessary.

The above-mentioned temporary fall arrest system uses known components for the most part, but includes a new bottom anchor assembly for securing a substantially vertically-oriented safety line to the lower portion of a tall structure. The anchor assembly is a quick-release device that is significant in being manually operable to working tension. The new bottom anchor also allows a safety line of indeterminate length to be installed, with the excess line being held on a spool beyond the bottom anchor. The bottom anchor is designed to grip the safety line in a non-destructive fashion so that it can be re-used repeatedly for a series of inspections on many tall structures. It can also accommodate differences in height between successive tall structures by allowing a different length of safety line to be passed through it before the gripping action is made.

In achieving the aforementioned objects, it should be borne in mind that the critical tension in a substantially vertically-disposed safety line is in its upper portion. The lower portion needs to be secured against the effects of buffeting by wind, but the safety line is inherently under tension below the top anchor by virtue of its own weight.

The invention is a bottom anchor assembly for a substantially vertically-oriented elongate safety line, said anchor assembly comprising safety line gripping means, safety line tensioning means and bracket means, wherein the gripping means includes a manually adjustable clamp and the tensioning means includes a hollow shaft through which the safety line passes, said hollow shaft being externally screw-threaded and being provided on its screw-threaded portion with load-setting means adapted to bear against the underside of said bracket means for adjusting the safety line tension to a predetermined value.

Preferably, the bracket means includes open jaw members adapted to receive the hollow shaft. This allows the load-setting means to be attached with the safety line already threaded through it. In a particularly preferred arrangement, the ends of the open jaw members are provided with downturned portions which serve to prevent accidental removal of the load-setting means threaded on the hollow shaft from between the jaw members once the system is adjusted to its predetermined tension.

Preferably, the manually adjustable clamp consists of a pair of clamp blocks adapted to be placed in face-to-face opposing relationship around the safety line immediately beneath the hollow shaft. Most preferably, the clamp blocks are provided with mutually-aligned grooves or recesses substantially conforming to the profile of the safety line. The clamp blocks may be loosely clamped to each other using screw-threaded fastening means for initial assembly and may include a further screw-threaded fastener for applying the final clamping torque.

The invention will now be described by way of example only with reference to the drawings, in which:

Figure 1 is a perspective view of an embodiment of the present invention in fully-assembled form;

Figure 2 is a perspective view of a manually-adjustable clamping arrangement in accordance with the present invention;

Figure 3 is an exploded perspective view of the arrangement depicted in Figure 2;

Figure 4 is an exploded perspective view of a tensioning device suitable for use in the present invention, and

Figure 5 is a close-up perspective view of a tensioning device in the process of being installed on a bracket in accordance with a preferred embodiment of the invention.

Referring firstly to Figure 1, there is shown a perspective view of a bottom anchor assembly 10 attached to a safety line 70 in the form of a multi-stranded metal cable. Typically, the cable diameter for a vertical fall arrest system is 8 mm.

The bottom anchor assembly consists of a bottom-mounted clamp 20, an externally screw-threaded hollow shaft 40 projecting upwardly from an upper surface of the clamp 20, a bracket 50 for attaching the anchor assembly to the lower portion of a tall structure such as an electricity pylon (not shown) and a load-setting device 80 a portion of which is adapted to bear against the underside of the jaws of the bracket 50. The hollow shaft 40 may include a

circlip 49 at its upper end for ensuring that the load-setting device, once installed on the hollow shaft 40, does not become inadvertently lost.

Referring now to Figures 2 and 3, the clamp 20 comprises a pair of clamp blocks 21, 31 adapted to be butted together in face-to-face opposing relationship around the safety line 70. The safety line 70 is omitted from these views for clarity. The clamp blocks 21, 31 each have a semi-circular groove 22, 32 formed in their respective opposing faces. The grooves 22, 32 may be provided with surface formation such as serrations, or a surface finish such as a metal spray for roughening, to enhance the gripping action on the safety line 70. As shown, one of the clamp blocks 21 is provided with a pair of countersunk bores 23, 24 whilst the other clamp block 31 is provided with a pair of threaded bores 33, 34 adapted to be in alignment with the countersunk bores 23, 24 when the clamp blocks are in opposing relationship. The bores 23, 24, 33, 34 receive respective threaded bolts 25, 35 which are used to assemble the clamping unit loosely for initial installation. The clamp block 21 further includes a plain through-hole 26, whilst the clamp block 31 further includes a third threaded hole 36 adapted to be in alignment with the through-hole 26 when the clamp blocks are in opposing relationship. The holes 26, 36 receive a wing nut 27 which is manually tightened to achieve the desired clamping force on the safety line 70.

The exploded view of Figure 3 does not allow this feature to be shown, but wing nut 27 is preferably captive in one of the clamp blocks, most preferably in the clamp block 31 having the threaded hole 36.

Still with reference to Figures 2 and 3, the clamp blocks 21, 31 each have a semi-circular recess 28, 38 in their uppermost surfaces, said recesses forming shoulder means 29, 39 at the junction of the recesses 28, 38 with the grooves 22, 32. The shoulder means 29, 39 form a platform upon which the hollow shaft 40 is positioned during installation of the anchor assembly.

The hollow shaft 40 is preferably held captive in the recesses 28, 38 when the clamp blocks 21, 31 are in opposing relationship by virtue of an undercut formation 28a, 38a provided at the base of recesses 28, 38. The undercut formation 28a, 38a is dimensioned to receive a flange 48 at the base

of hollow shaft 40. Preferably, the hollow shaft 40 is still capable of rotation relative to the clamp blocks 21, 31. This enables torsional stresses in the safety line 70 to be relieved whilst maintaining the desired tension.

Once fully installed, the anchor device behaves like a unitary assembly owing to the capture of the hollow shaft 40 in the clamping means 20. This also means that the device can be installed the other way up from the orientation shown in the drawings, since the hollow shaft 40 is held captive relative to the safety line 70 by virtue of its engagement in the clamping means 20.

The hollow shaft 40 has an external screw thread 41, the purpose of which is explained in detail below, and a through-bore 42 dimensioned to receive the safety line 70 as a loose sliding fit. The safety line 70 must not be an interference fit in the through-bore 42, otherwise it becomes difficult to control the tension in the system with precision. Neither is it desirable for the through-bore 42 to be very much wider than diameter of the safety line 70 since this results in the device being more bulky than necessary and may also increase the likelihood of safety line chafing at the ends of the hollow shaft 40.

Turning now to Figure 4, there is shown an embodiment of a load-setting means 80 in exploded perspective view. The load-setting means 80 comprises, in order from the bottom upwards, a first wing nut 81 having a screw threaded through-hole 81a of complementary thread pattern to the external screw thread 41 of the hollow shaft 40, an annular rubber block 82, and a second wing nut 83, also having a screw threaded through-hole 83a of complementary thread pattern to the external screw thread 41 of the hollow shaft 40. In use, the first wing nut 81 acts as a locking nut to secure the second wing nut 83 in position on the hollow shaft 40 when the load-setting means 80 has been adjusted to the desired tension. The rubber block 82 between the first and second wing nuts 81, 83 ensures that the assembly does not become locked up.

Next in order above the second wing nut 83 is a flanged collar 84 having an annular circlip-retaining groove 84a at its upper end. Above the collar 84 is a wave spring 85, then a thrust washer 86 and a spacer 87. In alternative embodiments, the wave spring may be substituted by a crest spring, a disc

spring, or even a compression spring. Also, the thrust washer 86 and the spacer 87 may be an integrally-formed single component. Above the spacer 87 is a tensor disc 88, typically in the form of a M24, Form D washer. The spacer 87 has a longitudinal dimension such that the jaws of bracket 50 are receivable between the upper surface of thrust washer 86 and the underside of tensor disc 88. The load-setting means 80 is completed by a retaining circlip 89 at the upper end as viewed in the Figure.

The components denoted by the reference numerals 85 to 89 form a unitary assembly on the shank of the flanged collar 84, the circlip 89 being received in the circlip-retaining groove 84a of the flanged collar 84. The flanged collar 84 has a plain bore that enables it to slide freely over the external screw thread 41 of the hollow shaft 40. The arrangement of the assembled load-setting means 80 is such that the wave spring 85 exerts a compressive force urging the tensor disc 88 into frictional engagement with the upper rim of the spacer 87 and the underside of circlip 89. This prevents rotation of the tensor disc 88 relative to its immediate neighbours, until the desired tension has been imparted to the system in the manner to be described in more detail below.

Referring now to Figure 5, this view shows a load-setting means 80 being slotted into the jaws 51, 52 of bracket 50. Here, the load-setting means 80 is shown in an inverted orientation relative to the exploded view of Figure 4. However, inversion of orientation does not affect the working principle of the load-setting means 80. As previously described, the ends of the bracket jaws 51, 52 have down-turned portions in the form of lugs 53, 54 (see also Figure 1) which serve to prevent the accidental removal of the load-setting means from between the jaws 51, 52 by inhibiting lateral movement of the load-setting means 80 once the system is adjusted to its predetermined tension. For the sake of clarity, the hollow shaft 40 and the safety line 70 have been omitted from Figure 5, but it will be understood from the explanation below that these features are present when the load-setting means 80 is installed in the bracket 50.

Referring once again to Figure 1, bracket 50 is releasably secured to the lower portion of a leg (not shown) of a tall structure such as a metal tower, a pylon, or the like in a known manner. Hollow shaft 40 carrying the load-setting means 80 is fed onto the safety line 70 from the direction of its free end indicated by the reference numeral 71 and positioned roughly adjacent the jaws 51, 52 of the bracket 50. The manually adjustable clamp 20 is then installed on the safety line 70 just beneath the hollow shaft 40 and is fastened to the safety line 70 by manually tightening the wing nut 27. At this moment during installation of the bottom anchor assembly 10, the safety line 70 is still free and sufficiently flexible that the load-setting device 80 can be tilted for insertion past the lugs 53, 54 of the bracket 50 and thence into the jaws 51, 52 thereof. The jaws 51, 52 of the bracket 50 are positioned between the thrust washer 86 and the tensor disc 88. The wing nut 83 is then rotated (by hand) to urge the flanged collar 84 upwards, forcing thrust washer 86 hard against the underside of the jaws 51, 52 of the bracket 50. The flanged collar 84 is moved upwardly relative to the thrust washer 86 by compressing the wave spring 85 until a point is reached when the tensor disc 88 is no longer held captive between the spacer 87 and the circlip 89, but is rotatable relative thereto. The point at which rotation of the tensor disc 88 is just possible indicates attainment of the desired tension in the system.

The first wing nut 81 can then be rotated (again by hand) against the resilience of rubber block 82 to lock second wing nut 83 and thereby ensure against relaxation of the tension in the safety line 70.

To release the safety line 70 from the bottom anchor assembly 10, the above procedure is reversed.

Because the bottom anchor assembly 10 uses a hollow shaft 40 and a non-terminal clamping block 20, the safety line 70 is permitted to extend beyond the bottom anchor assembly 10. There is no need to cut the safety line 70 to suit the height of the particular tall structure to which it is being fastened. Rather, the excess (that portion which extends in the direction of arrow 71) safety line can be coiled on a spool or drum onto which it can be re-

wound when the inspection is complete and the safety line installation is dismantled.

5 Although the invention has been particularly described above with reference to a specific embodiment, it will be understood that modifications and variations are possible without departing from the scope of the claims which follow.

## CLAIMS

1. A bottom anchor assembly for a substantially vertically-oriented elongate safety line, said anchor assembly comprising safety line gripping means, safety line tensioning means and bracket means, wherein the gripping means includes a manually adjustable clamp and the tensioning means includes a hollow shaft through which the safety line passes, said hollow shaft being externally screw-threaded and being provided on its screw-threaded portion with load-setting means adapted to bear against the underside of said bracket means for adjusting the safety line tension to a predetermined value.
2. A bottom anchor assembly as claimed in claim 1 wherein the manually adjustable clamp consists of a pair of clamp blocks adapted to be placed in face-to-face opposing relationship around the safety line immediately beneath the hollow shaft.
3. A bottom anchor assembly as claimed in claim 2 wherein the clamp blocks are provided with mutually-aligned grooves or recesses substantially conforming to the profile of the safety line.
4. A bottom anchor assembly as claimed in claim 3 wherein the clamp blocks are loosely clamped to each other using screw-threaded fastening means for initial assembly include a further screw-threaded fastener for applying the final clamping torque.
5. A bottom anchor assembly as claimed in any preceding claim wherein the bracket means includes open jaw members adapted to receive the hollow shaft.

6. A bottom anchor assembly as claimed claim 5 wherein the ends of the open jaw members are provided with down-turned portions which serve to prevent accidental removal of the load-setting means threaded on the hollow shaft from between the jaw members when the system is adjusted to its predetermined tension.
  7. A bottom anchor assembly as claimed in any preceding claim further comprising indicator means for providing a visible indication of when said predetermined tension has been achieved.
  8. A bottom anchor assembly for a substantially vertically-oriented elongate safety line substantially as described herein with reference to the drawings.
-

## ABSTRACT

## SAFETY LINE ANCHOR

A bottom anchor assembly (10) for a substantially vertically-oriented elongate safety line (70) comprises safety line gripping means (20), safety line tensioning means (80) and a bracket (50). The gripping means (20) includes a manually adjustable clamp (20) and the tensioning means (80) includes a hollow shaft (40) through which the safety line (70) passes. The hollow shaft (40) is externally screw-threaded and carries the load-setting means (80) on its screw-threaded portion (41). The load-setting means (80) is adapted to bear against the underside of the bracket (50) for adjusting the safety line tension to a predetermined value. The bracket (50) may have open jaws (51, 52) for receiving the hollow shaft (40) when it is already installed on the safety line (70). The ends of the open jaws (51, 52) may be provided with down-turned portions (53, 54) for preventing accidental removal of the load-setting means (80) from between the jaws (51, 52) when the system is adjusted to its predetermined tension.

(Figure 1 to accompany abstract)

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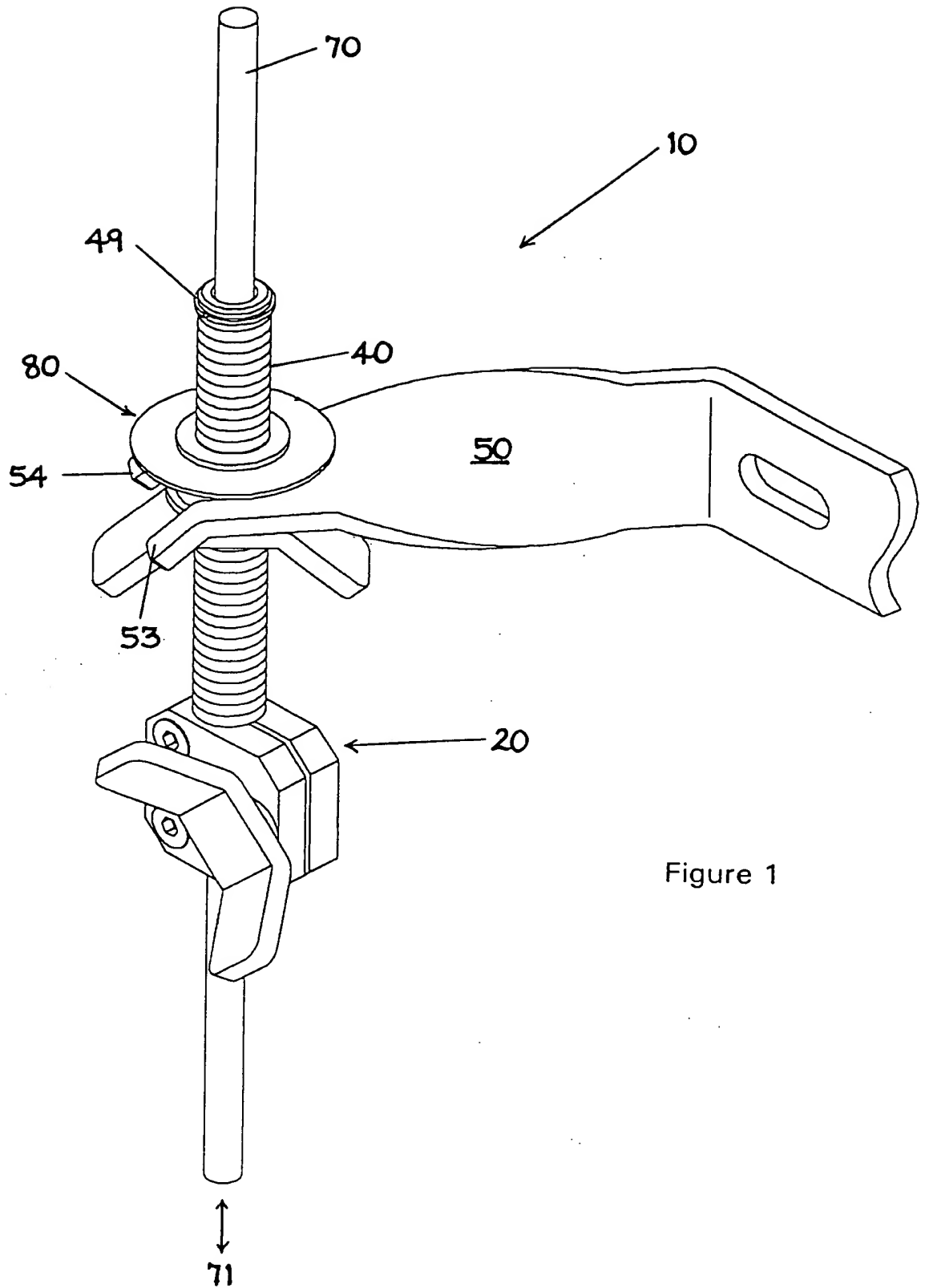


Figure 1

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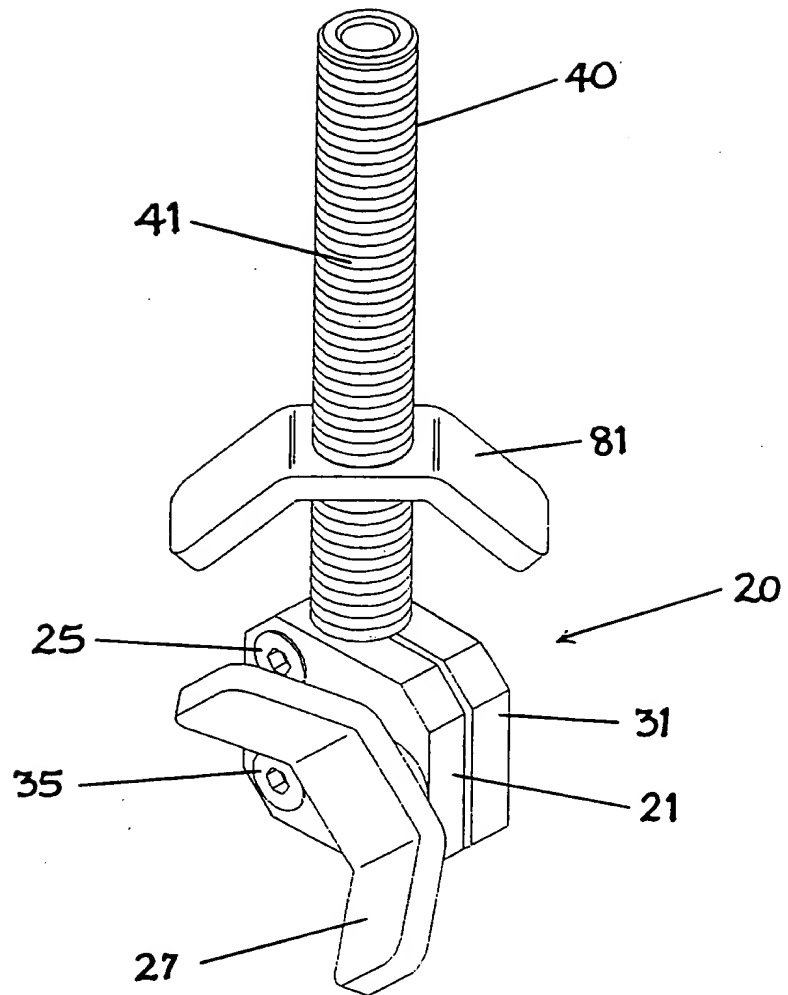


Figure 2

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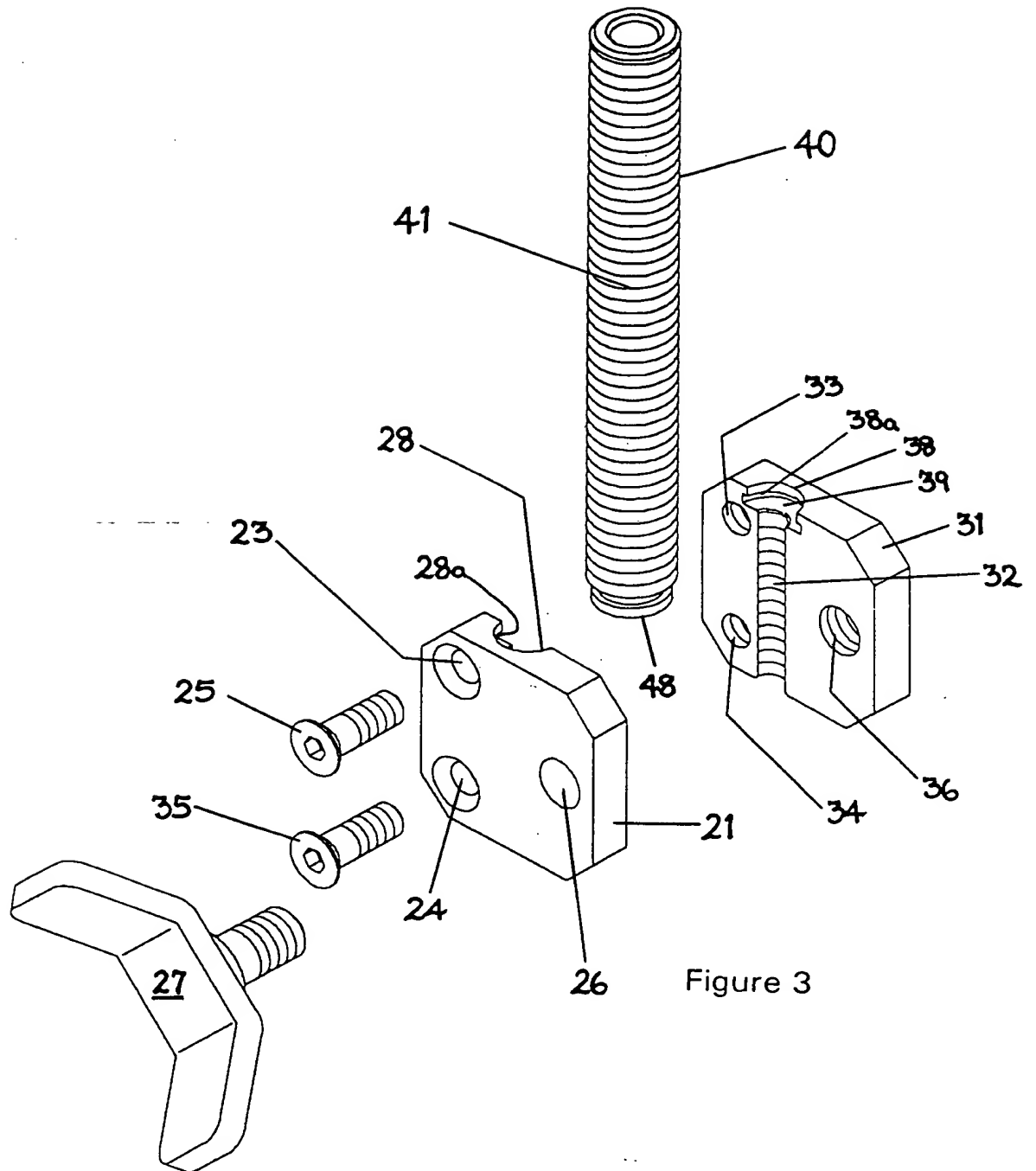


Figure 3

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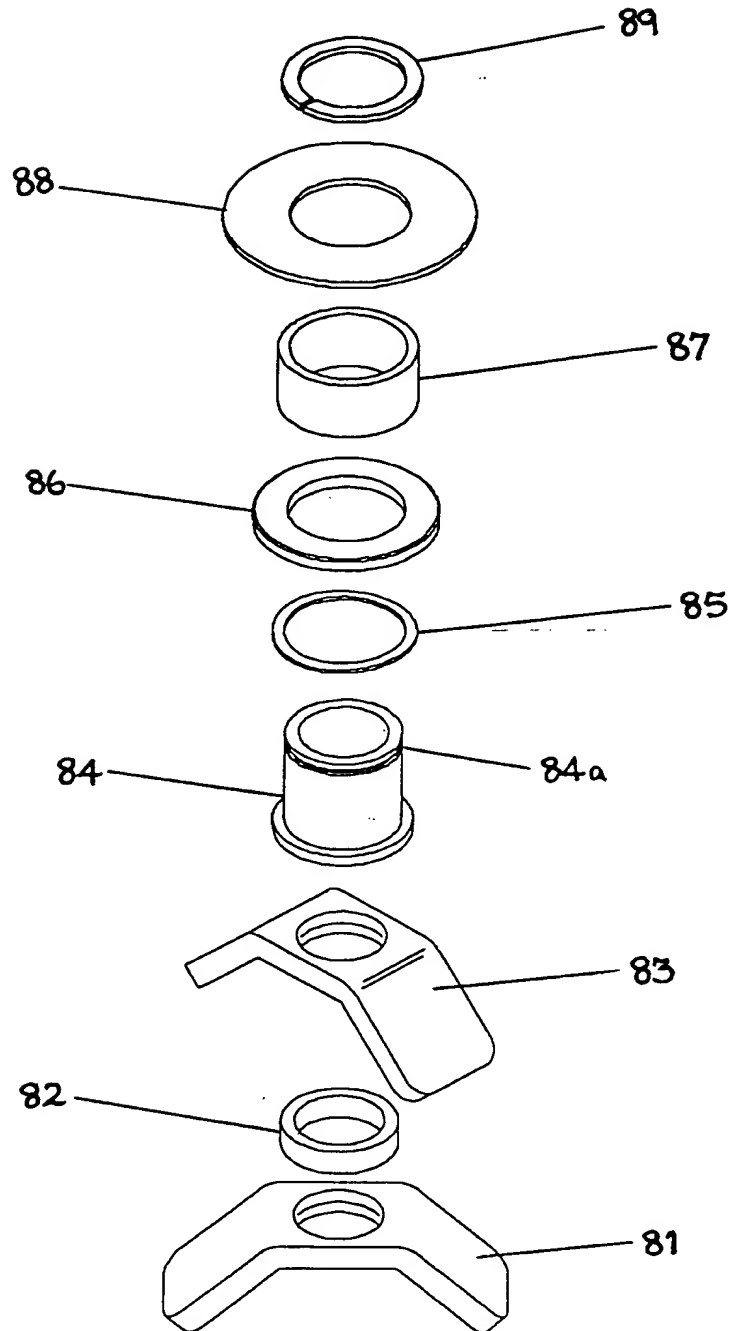


Figure 4

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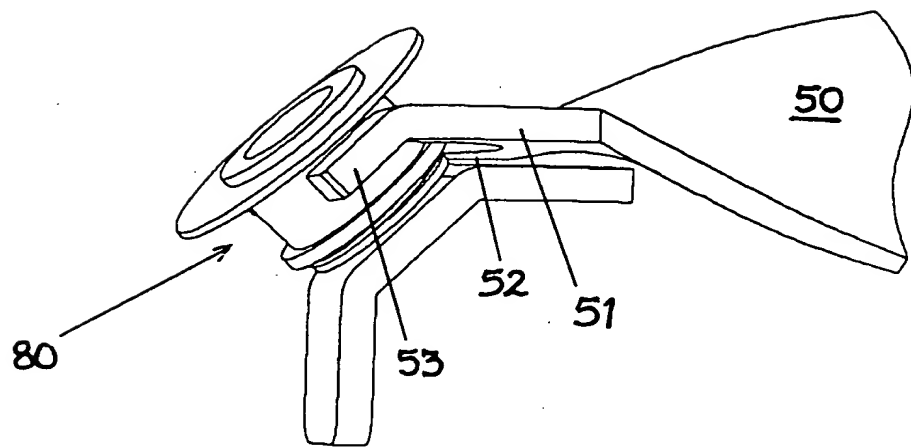


Figure 5

PCT/GB00/00371

F23/77 filed 8/2/00

Urguhart Dykes + Lord

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